

Summary

A group of oil and gas companies, collectively identified as the Powder River Basin Companies (Companies), has notified the U.S. Department of Interior, Bureau of Land Management (BLM) and U.S. Department of Agriculture, Forest Service (FS) of their intent to develop additional coal bed methane (CBM) resources in Wyoming's Powder River Basin (PRB). Implementation of this project would continue and expand development of CBM that has been occurring in the PRB over the last few years. In general, the Companies propose to:

- Drill, complete, operate, and reclaim almost 39,400 new natural gas wells and
- Construct, operate, and reclaim various ancillary facilities needed to support the new wells, including roads, pipelines for gathering gas and produced water, electrical utilities, and compressors.

The proposed project would occur in an almost 8,000,000-acre Project Area (Figure 1-1 in the EIS). This Project Area encompasses all or parts of Campbell, Converse, Johnson, and Sheridan counties and all or parts of eighteen 4th order watersheds (sub-watersheds). The proposed project would involve both public and privately owned lands. The public lands include lands administered by the BLM, National Forest System lands, and state lands. Additional information on land ownership and jurisdiction is presented in Chapter 3 of the EIS.

Purpose of and Need for the Proposed Action

The Companies hold valid federal, state, and private leases for oil and natural gas in the Project Area. The leases have created contractual and property rights for the Companies from the United States, the State of Wyoming, and private mineral owners to develop oil and natural gas resources. The purpose of the Companies' proposal is to extract, transport, and sell oil and natural gas at a profit from the portions of the Project Area leased by them.

The BLM and FS recognize the extraction of oil and natural gas is essential to meeting the Nation's future needs for energy. As a result, private exploration and development of federal oil and gas reserves are integral parts of the agencies' oil and gas leasing programs under the authority of the Mineral Leasing Act of 1920, as amended by the Federal Land Policy and Management Act (FLPMA) of 1976 and the Federal Onshore Oil and Gas Leasing Reform Act of 1987. The BLM and FS' oil and gas leasing program encourages the development of domestic oil and gas reserves and reduction of the United States' dependence on foreign sources of energy.

As a result of the contractual and property rights created by the valid leases, the direction contained within the BLM's oil and gas leasing program, the status of the BLM's two RMPs and the FS' LRMP and Oil and Gas Leasing Final EIS, the BLM and FS need to evaluate the level of development of oil and natural gas in

the Project Area over the next ten years. Specifically, the BLM and FS need to address the Proposed Action and reasonable alternatives to that action directly, indirectly, and cumulatively.

When the four primary guidance documents identified above were prepared, the levels of development for oil and natural gas anticipated at the time were less than levels currently proposed by the Companies and the agencies' current Reasonably Foreseeable Development (RFD) Scenario (Appendix A). In particular, the current and proposed levels of development of CBM were not specifically defined. Consequently, the BLM and FS need to evaluate conformance of the Proposed Action and alternatives to that action with the Buffalo RMP, Casper RMP, Medicine Bow National Forest's LRMP, and the TBNG Oil and Gas Leasing EIS and, if necessary, amend these documents to address the additional development comprising the selected alternative.

Therefore, this EIS serves five purposes. First, it provides the basis to analyze and disclose the impacts of the level of development proposed within the Project Area (both under the Proposed Action and RFD scenario). It addresses the effects of implementing a level of development of oil and natural gas within the Project Area that is conceptual in nature. The wells, roads, pipelines, and ancillary facilities depicted in this EIS represent a proposed level of development and tentative locations for these facilities. The final location for each component would be determined through future site-specific analyses that the BLM and FS would require for each facility. These analyses would occur when the Companies file applications for each component, such as an Application for Permit to Drill (APD), a FS Special Use Permit (SUP), or a BLM Right-of-Way (ROW) Grant.

Second, this EIS provides the means for the BLM and FS to provide federal minerals to meet the Nation's energy needs. It also facilitates protection of the financial interest of the United States by preventing the drainage of federal minerals.

Third, the EIS identifies mitigation measures to address issues and conditions of approval for the subsequent site-specific applications for individual locations. These measures and conditions would be incorporated into the process during permitting of the individual facilities (again through the APD, SUP, or ROW Grant processes).

Fourth, the FS will use the analysis documented in this EIS to revise the 1994 leasing decisions on those portions of the TBNG that have potential for CBM development (about 80,000 acres of National Forest System lands). The outcome of the impact analysis will be assessed against current lease stipulations to determine whether the current LRMP lease stipulations need to be modified or if new stipulations need to be developed. This decision would revise previous decisions made by the FS for the TBNG.

Finally, similar to the FS, the BLM is also using the outcome of the impact analysis to review the existing RMP decisions. This includes areas open and closed to leasing, lease stipulations, and authorized mitigation measures. This review will determine whether: (1) changes to current designations of areas open and closed to oil and gas leasing need to be made, (2) current RMP lease stipulations need to be modified or new stipulations need to be developed, and (3) new

mitigation measures need to be enacted. Should items one, or two, or both be determined to be necessary for either of the two RMPs, an amendment would be needed. If the decision maker determines the BLM needs to amend one or both RMPs, the analyses contained in this EIS will provide the basis for amending the RMPs. The Final EIS and ROD would serve as amendments to the Buffalo RMP and Casper RMP.

NEPA Process, Including Tiering and Decision Making

The National Environmental Policy Act (NEPA) and directives by the Council on Environmental Quality (CEQ) require the BLM and FS to analyze proposed actions involving federal lands and leases in terms of their potential effects on the human environment. Furthermore, regulations implementing the Mineral Leasing Act of 1920 require the BLM and FS to review and act on APDs and attached Surface Use Plans of Operations (SUPO) and to decide on the requirements for surface occupancy provided by the SUPO. The BLM and FS also issue ROW Grants and SUPs, respectively, to construct and operation linear transportation facilities, such as roads and pipelines, across federal lands under Title V of FLPMA and the Mineral Leasing Act.

The analysis of effects to the human environment discloses the potential environmental consequences of proposed actions and alternative actions. Another responsibility of the BLM and FS is establishing provisions for ensuring the reclamation of facilities and disturbed lands if an oil and gas operator would fail to complete adequate reclamation efforts. Bonds are required for oil and gas operations on federal leases to indemnify the government for safe rehabilitation, royalty payments, and civil penalties. Bonds also are required for ROWs on federal lands.

The BLM, Buffalo Field Office in Buffalo, Wyoming is the lead federal agency responsible for conducting the NEPA analysis and preparing this EIS. The FS (Medicine Bow National Forest) is a cooperating agency and is responsible for protecting non-mineral resources on National Forest System lands in the TBNG. The development of the Proposed Action and the alternatives was conducted by an oversight team consisting of the BLM, FS, State of Wyoming agencies, five conservation districts, and the four counties. Wyoming agencies specifically designated to represent the State as a cooperating agency on this team included the Office of Federal Land Policy, Department of Environmental Quality (WDEQ), the Wyoming Oil and Gas Conservation Commission (WOGCC), and Wyoming State Engineer (WSEO). The State also designated another eight agencies to assist these four agencies.

This document provides the responsible agencies with information upon which to base a final decision that considers factors relevant to the proposal. Scoping issues and concerns raised by the public and agencies drove the development of alternatives and focused the environmental impact analysis. This EIS documents (1) the analysis of effects that could result from implementation of the Proposed Action or alternatives and (2) the development of environmental protection measures necessary to reduce or eliminate environmental consequences.

The regulations implementing NEPA encourage tiering in EISs. Tiering is the process of referencing information presented in other previously prepared NEPA documents, such as EISs to minimize repetition. This EIS is specifically tiered to the four guidance documents identified previously.

Finally, this EIS is not a decision document; it documents the process used to analyze the potential environmental consequences of implementing the proposed oil and gas development project and alternatives to the Proposed Action. The decisions about the proposed project will be documented in separate RODs (one for the BLM and one for the FS) signed by the agency's responsible official. The BLM and FS' decisions will apply to federal lands and leases administered by both agencies. Decisions by other jurisdictions to issue or not to issue approvals related to this proposal may be aided by the disclosure of effects available in this analysis.

Decisions to be Made Based on this NEPA Analysis

The decision makers for the BLM (Wyoming State Director) and FS (Medicine Bow-Routt National Forests Supervisor) will decide based on the analysis documented in this EIS, whether current RMP or LRMP lease stipulations are adequate or if new stipulations need to be developed. They will determine whether any changes to current designations of areas open or closed to oil and gas leasing need to occur. Also, they will determine if new mitigation measures need to be adopted, and if any of the management plans need to be amended.

Decisions to be Made Following this NEPA Process

The RODs associated with this EIS will not be the final review or the final approvals for all actions associated with the PRB Oil and Gas Project. Although the RODs would approve a maximum level of oil and gas development and its general location, the BLM and FS must analyze and approve each component of the project that involves the disturbance of federal lands on a site-specific basis. The method used to evaluate each surface-disturbing activity is the APD or ROW Grant/SUP, which would be required before any construction can occur.

The APD includes a surface use program and a drilling plan. The detailed information to be submitted under each program is identified in Onshore Oil and Gas Order No. 1 and 43 Code of Federal Regulations (CFR) 3162.3. An on-site inspection of the locations proposed for the well, access road, pipelines, and other areas of proposed surface use would be conducted before approval. The inspection team would include the BLM, FS (if construction would occur on National Forest System lands), the lessee or its designated representative, the primary drilling and construction contractors, and federal grazing lessees. For inspections involving split estate lands (lands with private surface ownership and federal minerals ownership), the BLM also would invite the surface owner to attend.

The purpose of the on-site inspection would be to identify potentially sensitive areas and the environmental consequences associated with the proposal at each specific location and site-specifically apply the methods needed to mitigate those effects. The on-site could include site-specific surveys for cultural resources or threatened or endangered species, if the potential for occurrence of these resources exists on or near the proposed disturbance. After the site inspection, the APD may be revised or site-specific mitigation may be added as Conditions of Approval to the APD, consistent with applicable lease terms, for the protection of surface or subsurface resource values near the proposed activity. These may include adjusting the proposed locations of well sites, roads, and pipelines; identifying the construction methods to be employed; and identifying reclamation standards for the lands.

Since the issuance of the ROD for the Wyodak Final EIS, the BLM has been requiring that CBM projects be submitted as Plans of Development (POD). A POD is a group of wells and their supporting infrastructure (e.g., roads, pipelines, power lines, water discharge points, booster stations, and compressor stations) for a given geographic area or sub-watershed. The POD helps the operators develop a logical, economical, environmentally sound CBM project that the BLM can efficiently process and approve.

The BLM is responsible for conducting an environmental analysis on BLM lands (BLM surface ownership and all federal minerals ownership), preparing the documentation, and providing mitigation measures to protect surface resources for APD approval. The FS would have similar responsibilities on National Forest System lands. The BLM is responsible for approval of the drilling program, protection of ground water and other subsurface resources, and final approval of the APD on both BLM and National Forest System lands.

Access roads and pipelines on BLM-managed land outside the applicant's lease would require a ROW Grant. Likewise, facilities on National Forest System lands would require an SUP. The APD could be acceptable as an application for a ROW Grant or SUP for off-lease facilities, if it provides sufficient detail of the entire proposal.

After drilling, routine well operations would not require approval. However, the BLM would have authority for approving a variety of related activities. Any changes to an approved APD, certain subsequent well operations, and all subsequent new surface disturbances, such as workover pits, would require prior approval. Complete details of subsequent well operations are contained in 43 CFR 3162.3-2. Disposal of produced water from Federal leases would require prior approval, as outlined in Onshore Oil and Gas Order No. 7. The BLM also would approve plugging and abandonment of wells, hydrogen sulfide protection measures (if necessary), gas venting, gas flaring, and certain measures for handling production.

Public Participation

The BLM and FS consider public participation a crucial component in defining the scope of the environmental analysis presented in this EIS. Consequently, the agencies worked to ensure the public was informed about the Companies' pro-

posal and the opportunities available for participating in the environmental process.

The agencies first informed the public of the BLM and FS' intent to conduct an environmental impact analysis of oil and gas development within the PRB during May and June 2000. In May, the agencies prepared and mailed almost 900 copies of a Scoping Letter, which solicited comments from its readers to assist the BLM and FS in identifying the specific issues and concerns the agencies should address in the analysis and document in the EIS.

On 21 June 2000, formal scoping for the analysis began with publication in the Federal Register of a Notice of Intent (NOI) to prepare an EIS. The BLM published additional notices in the Federal Register to correct mistakes in the first NOI and to invite the public's participation in the analysis and potential amendments to the Buffalo and Platte River Resource Management Plans.

The BLM also sent a news release to more than 60 media outlets (e.g., newspapers, radio stations, and television stations) in Wyoming and Montana. This news release announced the agencies' intention to prepare an EIS and identified the public meetings. Additionally, several newspapers prepared stories on the project.

In addition to the publications and mailings, the agencies held four public meetings to discuss the proposal and receive comments from the public. The first meeting was held in Sheridan, Wyoming on 6 June 2000. The second and third meetings were held in Buffalo, Wyoming and Gillette, Wyoming on 7 and 8 June 2000, respectively. The final meeting was held in Douglas, Wyoming on 12 June 2000. At all meetings, the proposal was described and attendees were provided the opportunity to ask questions and submit comments.

Finally, the BLM and FS have been keeping the public informed of the analysis' status through a periodic newsletter and project-specific web site (www.prb-eis.org). The BLM also placed project information on its Wyoming web site.

Issue Identification and Issue Statements

The BLM and FS reviewed and analyzed the comments they received during the scoping process. Public response to the notices and meetings included 74 letters, comment forms, and e-mails. Also, a total of 106 people attended one or more of the four public meetings.

The agencies' process for identifying issues involved three overall steps. First, specific comments were arranged into groups of common concerns. Next, a primary issue statement was prepared for each group of comments. Finally, the issue statements were evaluated for applicability to this NEPA analysis.

The analysis of comments initially identified 27 issues. Eighteen of these 27 issues were identified as key or significant issues (see November 2000 Scoping Summary to review nonsignificant issues). These issues were used to define the scope of this NEPA analysis. These key issues were used to analyze environmental effects, prescribe mitigation measures, or both. Issues are "significant or

key” due to the extent of their geographic distribution, the duration of their effects, or the intensity of interest or resource conflict. The determination of an issue’s significance is different than and separate from any determination of the significance of an environmental consequence. The other nine issues were not identified as key because they involved standard parts of a NEPA analysis (e.g., the analysis must consider an adequate range of alternatives) or the agencies determined they were beyond the scope of this NEPA analysis. The 18 key issues that comprised the overall scope of the NEPA analysis are:

Issue 1: The effects of the additional development of oil and gas resources on aquifers present in and down gradient of the project area.

Issue 2: The effects of the additional development of oil and gas resources on the quantity and distribution of surface water in and downstream of the project area.

Issue 3: The effects of the additional development of oil and gas resources on the quality of surface water in and downstream of the project area and the potential to adversely affect current uses of those surface waters.

Issue 4: The effects of the additional development of oil and gas resources on the project area’s geology, geologic hazards, and the extraction of other mineral resources present in the project area.

Issue 5: The effects of the additional development of oil and gas resources on soils in and downstream of the project area.

Issue 6: The effects of the additional development of oil and gas resources on air quality and visibility.

Issue 7: The effects of the additional development of oil and gas resources on vegetation in and downstream of the project area, including wetlands and riparian areas.

Issue 8: The effects of the additional development of oil and gas resources on species of wildlife and their habitats (particularly key species and habitats).

Issue 9: The effects of the additional development of oil and gas resources on fisheries and aquatic habitats.

Issue 10: The effects of the additional development of oil and gas resources on the project area’s ecological integrity and biological diversity.

Issue 11: The effects of the additional development of oil and gas resources on special-concern species, particularly threatened, endangered, candidate, or sensitive species of plants and animals.

Issue 12: The effects of the additional development of oil and gas resources on rangeland resources and grazing operations.

Issue 13: The effects of the additional development of oil and gas resources on cultural resources, paleontological resources, and Native Americans.

Issue 14: The effects of the additional development of oil and gas resources on recreational opportunities and the recreational experience.

Issue 15: The effects of the additional development of oil and gas resources on the project area’s aesthetics.

Issue 16: The effects of the additional development of oil and gas resources on the local economy.

Issue 17: The effects of the additional development of oil and gas resources on human health and safety.

Issue 18: The analysis needs to include an analysis of environmental justice.

Alternatives Analyzed in Detail

Three alternatives were analyzed in detail: (1) Proposed Action, (2) Proposed Action with Reduced Emission Levels and Expanded Produced Water Handling Scenarios, and (3) No Action.

Alternative 1 – The companies’ proposed action was combined with the BLM’s Reasonable Foreseeable Development (RFD) Scenario. The RFD Scenario is based primarily on geology (potential for oil and gas resource occurrence) and past and present oil and gas activity, with consideration of other significant factors such as economics, technology, and physical limitations on access, existing or anticipated infrastructure and transportation.

Along with industry’s proposed action, which relates only to coal bed methane activity, the BLM’s RFD forecasts the continued drilling of an estimated 3,200 oil wells. The RFD also forecasts there could be an estimated 51,000 CBM wells in the EIS area over the next ten years.

The companies’ projections of CBM well drilling and production include various ancillary facilities within the Project Area. The ancillary facilities include access roads, pipelines for gathering gas and produced water, electrical utilities, facilities for treating and compressing gas and disposing of produced water, and pipelines for delivering gas under high pressure to transmission pipelines. Although the Companies would develop new wells throughout the 10-year period beginning in 2002, most of the drilling would occur during the first eight years. All 51,000 wells would not be drilled into a single coal seam. Wells drilled into different coal seams can be collocated on common well pads. The projected number of well pads is 35,589. The total numbers of wells and well pads is based on an 80-acre well spacing pattern (eight pads per square mile). The 51,000 proposed CBM wells include an estimated 12,000 existing wells.

Under the Proposed Action, the Companies would construct, operate, and maintain wells and ancillary facilities in 10 of the 18 sub-watersheds that comprise the Project Area. However, most of the new wells (63 percent) and facilities would be constructed in two sub-watersheds: the Upper Powder River and Upper Belle Fourche River sub-watersheds. Sub-watersheds with relatively high numbers of wells and facilities include Clear Creek, Crazy Woman Creek, Tongue River, and Little Powder River.

Overall, implementation of the Proposed Action could disturb as many as 212,000 acres. This short-term disturbance would encompass about 3 percent of the Project Area. Most of this would be associated with the construction of pipelines and roads. Long term disturbance is projected to be approximately 109,000 acres. Compressor stations would account for the smallest amount of the overall disturbance.

Construction of the Powder River Basin wells would begin during 2002. Generally, construction of most CBM wells would be completed over the first eight years (by the end of 2010). The production lifetime of the wells is expected to be about 7 years and final reclamation is expected to be completed during the two to three years following the end of production.

Emphasis for water handling for Alternative 1 is untreated surface discharge. All compression would be CBM powered.

Alternative 2 proposes the same number of CBM and conventional wells as the proposed action. There are two additional water-handling methods analyzed: A – Emphasis on infiltration and B – emphasis on treatment for beneficial use.

There are also two air quality options: A- Fifty percent of the booster compression would be electrically powered and B – One hundred percent of the booster compression would be electrically powered.

Alternative 3 – No Action This alternative would consist of no new federal wells. Wells would only be developed on state and private mineral ownership.

Affected Environment

The PRB is part of the Missouri Plateau of the Great Plains. This region is characterized by rolling uplands that have been greatly dissected by tributaries of the Missouri River system. The Bighorn Mountains, which are part of the Rocky Mountains, lie just west of the PRB, partially within the westernmost portion of the Project Area. On the east, the PRB is bounded by the Black Hills. On the south, the PRB is bounded by the Casper arch, the Laramie Mountains, and the Hartville Uplift.

The PRB consists of a dissected, rolling upland plain, with low to moderate relief, broken by buttes, mesas, hills, and ridges. Extensive areas of open high hills in the northern portion of the Project Area indicate rough, broken terrain where moderate to deep erosion has occurred. Erosion-resistant clinker, produced by the natural burning of coal beds in the PRB, caps many hills and ridges within the Project Area with a characteristic broken, red brick or scoria-like rock. Elevations in the Project Area range from 3,350 to 9,250 feet above msl.

The PRB is drained toward the north and east by the Tongue, Powder, Little Powder, Belle Fourche, and Cheyenne Rivers, which all flow into the Missouri River system. The Project Area forms a low divide among these smaller drainage systems. The major river valleys have wide flat floors and broad floodplains. Tributaries in the Project Area are incised and drain areas of isolated, flat-topped, clinker-covered buttes and mesas, 100 to 500 feet above the valley floor. Flow in the Project Area is generally towards the northeast. Perennial streams generally originate in the mountainous areas because of significant annual precipitation and geologic conditions that foster groundwater discharge.

Surface water quality in the Project Area is generally adequate to support designated uses. Surface waters in the Project Area are typically alkaline, with moderate to high levels of hardness. These waters vary from a calcium bicarbonate type

water in the mountain streams, to a sodium sulfate type water in the lowlands. Surface water quality in the Project Area is affected by depletions and return flows from irrigation. Surface water withdrawals in the Project Area are used to support agricultural, domestic, and stock water uses. Irrigation use accounts for about 98 percent of the surface water withdrawals in the Project Area.

The groundwater resources of the PRB that are at or near the land surface within the PRB are contained in unconsolidated Quaternary alluvial or basin fill deposits or in semi-consolidated to consolidated lower Tertiary sandstones and coal beds that are the uppermost aquifers in the Northern Great Plains aquifer system. Clinker, which is also an aquifer, has formed from some of the lower Tertiary sediments. The Lower Tertiary Aquifer System consists of the Wasatch aquifers, the Fort Union aquifers contained in the Tongue River member of the Fort Union Formation, the Lebo confining layer, and the Tullock aquifer.

The PRB contains some of the largest accumulations of low sulfur sub-bituminous coal in the world. Thick coal deposits occur at or near the surface along the eastern boundary of the Project Area, along a north-south trend situated west of both Gillette and Wright, and in the northwestern portion of the Project Area. Important coal seams within the Wasatch Formation, from oldest to youngest, include the School, Badger, Felix, and Lake De Smet coals. Important coal seams within the Fort Union Formation, from oldest to youngest, include the Canyon, Anderson, Wyodak, and Big George coals. About 25 trillion cubic feet (tcf) of CBM may be recoverable from coal beds in the PRB within Wyoming.

Although specific air quality monitoring is not conducted throughout most of the Project Area, air quality conditions in rural areas are likely to be very good, as characterized by limited air pollution emission sources (few industrial facilities and residential emissions in the relatively small communities and isolated ranches) and good atmospheric dispersion conditions, resulting in relatively low air pollutant concentrations. Occasional high concentrations of carbon monoxide (CO) and particulate matter may occur in more urbanized areas (e.g. Buffalo, Gillette, and Sheridan) and around industrial facilities, especially under stable atmospheric conditions common during winter.

The Project Area is characterized as a mosaic of vegetation types that includes prairie grasslands, shrublands, riparian areas, and forested areas. Fourteen vegetation types were identified within the Project Area. They are short-grass prairie, mixed-grass prairie, wet meadow, herbaceous riparian, sagebrush shrubland, other shrubland, shrubby riparian, coniferous forest, aspen, forested riparian, agriculture, urban/disturbed, barren, and water. These broad categories often represent several vegetation types that were similar in terms of dominant species and ecological importance.

All of the vegetation types present in the Project Area provide habitats for some wildlife species. In an undisturbed condition, the major vegetation types in the Project Area provide high-quality habitats for many wildlife species. Because these habitats tend to occur in a mosaic across the landscape, many wildlife species can be expected to use more than one habitat. Primary species of wildlife of concern in the Project Area include the pronghorn antelope, mule deer, white-tailed deer, elk, moose, sage grouse, sharp-tailed grouse, and various raptors.

Perennial streams in the Project Area support a diverse fish fauna of mostly native, game and nongame species.

Not surprisingly, the Project Area supports a variety of special-status species about which management agencies are concerned. These species of plants and animals include those listed by the U.S. Department of Interior, Fish and Wildlife Service (USFWS) as threatened or endangered or being considered for listing as threatened or endangered. They also include species that the BLM or FS consider rare or sensitive.

A variety of prehistoric and historic cultural resource sites that have been documented in each of the sub-watersheds in the Project Area by site type or historic theme, and by National Register evaluation. The files search for this area contains a high proportion of sites that are unevaluated or for which information on evaluation is lacking – 35.6 percent for prehistoric and 35 percent for historic. The files search tables show 13 percent of the prehistoric sites and 9.6 percent of the historic sites as listed or eligible. Typically, when adequate information is available, about 10 to 15 percent of the documented sites in an area are evaluated as eligible for listing in the National Register of Historic Places.

Land ownership in the Project Area consists primarily of private lands intermingled with federal and state lands. Mineral ownership in the Project Area consists primarily of federal mineral estates. Rangeland/livestock grazing is the dominant land use for both public and private lands in the Project Area.

Gillette and Sheridan are the hubs for the transportation network in the Project Area. Interstate highways in the Project Area include I- 25 and I-90. The major north-south transportation corridors include State Route 59 in Campbell and Gillette Counties, and I-25 in Johnson and Sheridan Counties. The principal east-west highway for Campbell and Johnson Counties is I-90. I-90 runs north from the Town of Buffalo to the City of Sheridan, and then continues north to the Montana State line. U.S. Highways in the Project Area include U.S. Routes 14, 16 to the East of Buffalo, and 87. The Primary State Highways in the Project Area are Routes 59, and 387. Secondary State Highways traversing the area include Routes 50, 51, 192, 196, 338, and 450. Numerous county roads also provide local access to public and private lands within the Project Area.

Oil and gas pumping units and associated well pads and access roads are evident throughout the Project Area. However, most of the existing well development is in the eastern half of the Project Area. Well development is most evident in Campbell County between the cities of Gillette and Wright, and north, west, and northwest of Gillette. Development is also evident along Interstate 90 and State Highway 14 and 93 in Campbell and Sheridan Counties. The landscape that has resulted from ongoing oil and gas development in this area is rural/industrial in character.

Most of the areas with significant scenic values occur in the western part of the Project Area. The South Big Horns Area is located in the southwest quarter of Johnson County, primarily within the Middle Fork Powder River sub-watershed. The area provides sensitive and unique resource values, including scenery. Special management areas within the South Big Horns Area include the Middle Fork

Recreation Area, the Red Wall/Hole-in-the-Wall area, Outlaw Cave, Dull Knife Battlefield site, and the Gardner Mountain and North Fork Wilderness Study Areas. The Powder River breaks in eastern Johnson County, the Fortification Creek SMA and WSA, and the Weston Hills Recreation Area in the eastern part of the Project Area also provide scenic settings for a variety of dispersed recreational activities.

Two scenic byways exist in the western part of the Project Area. They provide access to the Bighorn Mountains. The Bighorn Scenic Byway is on U.S. Route 14 west of Ranchester. The Cloud Peak Skyway is on U.S. Route 16 west of Buffalo.

Recreational use of the Project Area is limited because more than 75 percent of the land is privately owned. Opportunities for dispersed recreation exist on federal and state lands throughout the Project Area. A few developed recreational sites or facilities exist within special management areas on federal lands in the Project Area. Developed recreational facilities, such as campgrounds, are generally limited to private lands in or near to larger communities in the Project Area, and to state historical sites located in the western part of the Project Area. Communities in the Project Area, including Sheridan, Gillette, Wright, Buffalo, and Kaycee, provide a variety of municipal and private recreational facilities, including golf courses, rodeo grounds, ball parks, and swimming pools.

Major sources of noise are towns; industrial facilities; major roadways, such as Interstate 90; railroad corridors; and frequent high winds. Noise in rural areas away from industrial facilities and transportation corridors is generally 30 to 40 dBA when the wind speeds are low. Levels of noise close to industrial facilities and transportation corridors are likely to be in the range of 50 to 70 dBA depending on the proximity to these sources. The most significant noise from CBM operations results from the operation of compressor stations that use multiple engines to move natural gas from central gathering facilities and along high-pressure transmission pipelines. Noise from these compressor stations has been estimated to be 55 dBA at 600 feet from the compressor station.

The Project Area encompasses all or portions of Converse, Campbell, Johnson, and Sheridan counties in Wyoming. It also includes four incorporated municipalities: Gillette, Wright, Sheridan, and Buffalo. Gillette is the county seat and the largest incorporated city in Campbell County. Wright is in southern Campbell County. Sheridan is the county seat of Sheridan County and Buffalo is the county seat of Johnson County.

Summary Comparison of Alternatives and Environmental Consequences

The following tables summarize the alternatives considered in detail and the likely environmental consequences of each alternative. S-1 contains the summary of alternatives. This table contrasts the four alternatives in terms of their physical characteristics. The matrix presented in S-2 provides a comparison summary of the effects to the various environmental resources that would be real-

ized by implementing each of the four alternatives for the Powder River Basin Oil and Gas Project.

Agency-Preferred Alternative

The BLM's preferred alternative is Alternative 1 — Proposed Action. This alternative provides for the best balance of effects to costs and development of the CBM. Most of the federal minerals in the Project Area have already been leased. The pattern of federal and non-federal mineral ownership coupled with the BLM's responsibilities under 43 CFR 3162.2 to prevent drainage of federal oil and gas preclude the BLM from choosing Alternative 3 as the preferred alternative.

Alternatives 2A and 2B offer some advantages over Alternative 1; however, the advantages are insufficient to justify the additional costs and disturbance. Both alternatives 2A and 2B would increase short- and long-term disturbance over Alternative 1 by at least 10 percent. However, as documented in the analysis they would not substantially decrease effects to air quality, visibility, and water quality — the primary issues for which the alternatives were developed. The amount of CBM water produced by alternatives 1, 2A, and 2B would be the same. The costs of implementing the water handling procedures of alternatives 2A and 2B would be substantially higher than those associated with Alternative 1, but the difference between the effects of these two alternatives and Alternative 1 does not reflect or justify these additional costs. The analysis documents that the benefits to air quality and visibility from electrifying half or all of the booster compressors would be insufficient to justify the additional costs of requiring the Companies to use electric booster compressors. It is estimated that few booster compressors would be built on surface that is federally owned and BLM does not have the ability to require electrification of compressors constructed off of federal surface. The permitting of the compressors is the responsibility of the State of Wyoming.

Proposed RMP/LRMP Amendments

The FS is using the analysis documented in this EIS to make a decision on authorization of leases on those portions of the TBNG that have potential for CBM development. The FS has released a Final EIS and Proposed LRMP for the TBNG. In that analysis, they deferred the lease authorization decision for this analysis. The lease availability decision will be made in the ROD for the LRMP EIS.

The outcome of the impact analysis has shown no need for changes to areas open and closed to oil and gas leasing or stipulations proposed in the Final LRMP EIS. Several new mitigation measures would be required for lease authorization.

The BLM has also reviewed the existing RMP's against the NEPA impact analysis. Proposed for the Buffalo RMP:

- No changes to current designations of areas open or closed to leasing.
- No changes to current, or addition of any new, lease stipulations.

- No changes to current resource objectives or decisions.
- Several new mitigation measures would be implemented.

The proposed RMP amendment would include this impact analysis of the new RFD for oil and gas.

Proposed for the Platte River RMP:

- No changes to current designations of areas open or closed to leasing.
- No changes to current, or addition of any new, lease stipulations.
- No changes to current resource objectives or decisions.
- Several new mitigation measures would be implemented.

The proposed RMP amendment would include this impact analysis for the Converse County portion of the Project Area.

The Final EIS and ROD would serve an amendment to the Buffalo RMP. The FS would need a ROD for their authorization decision.

Table S-2 Summary Comparison of Alternatives Considered in Detail

Parameter	Alternative			
	1	2A	2B	3
<i>New CBM Facilities</i>				
<i>Number of Wells</i>				
Federal ownership	23,909	23,909	23,909	0
Non-federal ownership	15,458	15,458	15,458	15,458
Total	39,367	39,367	39,367	15,458
<i>Number of Well Pads</i>				
Federal ownership	15,455	15,455	15,455	0
Non-federal ownership	10,542	10,542	10,542	10,542
Total	25,997	25,997	25,997	10,542
<i>Roads (miles)</i>				
Improved	6,657	6,657	6,657	2,170
Two-track	10,619	10,619	10,619	4,337
<i>Pipeline (miles)</i>				
2-3-inch poly	14,127	14,127	14,127	5,769
12-inch poly	5,311	5,311	5,311	2,170
12-inch steel	1,036	1,036	1,036	396
<i>Overhead Electric Line (miles)</i>	5,311	5,311	5,311	3,170
<i>Compressors</i>				
Number of booster units	1,060	1,060	1,060	350
Number of booster stations	186	186	186	175
Total horsepower of booster units	371,000	371,000	371,000	122,500
Number of reciprocating units	298	298	298	97
Number of reciprocating stations	63	63	63	19
Total horsepower of reciprocating units	491,700	491,700	491,700	160,050
<i>Water Handling Facilities</i>				
Analyzed number of surface discharge facilities	1,216	498	795	419
Analyzed number of infiltration facilities	1,821	4,032	2,931	893
Analyzed number of containment impoundments	37	43	36	16
Analyzed number of injection wells	285	342	342	147
<i>Projected Short-term Disturbance (acres)</i>	211,992	230,886	222,860	90,807
<i>Projected Long-term Disturbance (acres)</i>	108,799	127,693	119,667	45,057
<i>Workforce Requirements</i>				
Construction and installation (number of workdays)	2,403,944	2,805,164	2,594,436	803,769
Operation and maintenance (number of workdays)	1,814,275	1,815,831	1,815,020	704,814
Reclamation and abandonment (number of workdays)	1,427,421	1,713,259	1,568,892	405,719
<i>New non-CBM Facilities</i>				
<i>Number of new wells</i>				
Federal ownership	1,791	1,791	1,791	0
Non-federal ownership	1,409	1,409	1,409	1,409
Total	3,200	3,200	3,200	1,409
<i>Projected short-term disturbance (acres)</i>	17,599	17,599	17,599	7,751
<i>Projected long-term disturbance (acres)</i>	14,402	14,402	14,402	6,339
<i>Workforce Requirements</i>				
Construction and installation (number of workdays)	96,800	96,800	96,800	43,712
Operation and maintenance (number of workdays)	73,600	73,600	73,600	29,275
Reclamation and abandonment (number of workdays)	19,200	19,200	19,200	8,070

Table S-2 Summary of Effects, by Alternative

Potential Effect	Alternative			
	1	2A	2B	3
<i>Groundwater</i>				
Maximum Drawdown				
Fort Union Formation	300–1,200 feet	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Deep Wasatch Sands	10–250 feet	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Shallow Wasatch Sands	1–50 feet (in areas of thin Wasatch cover)	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
	-1 to –50 feet (below impoundments and creeks receiving CBM discharge)	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Period of Maximum Drawdown				
Fort Union Formation	2006–2009	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Deep Wasatch Sands	2009–2018	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Shallow Wasatch Sands	2006–2012 (drawdown areas) 2006–2009 (buildup areas)	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Recharge	Recharge of shallow Wasatch increased during CBM development due to infiltration below creeks and impoundments receiving CBM discharge water.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Quality	Groundwater quality within the regional aquifer systems and alluvial aquifers would not be noticeably affected.	Same as Alternative 1	Same as Alternative 1.	Same as Alternative 1
Recovery	Rapid initial recovery of water levels in developed coals following cessation of CBM pumping. Typically >80% recovery within first 10 years. Recovery to within 20 to 50 feet of pre-development water levels occurs over 50 to 100 years. Similar pattern for deep Wasatch Sands but lagged by about 10 years.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1

Table S-2 Summary of Effects, by Alternative

Potential Effect	Alternative			
	1	2A	2B	3
Springs/Wells	Wells completed in developed coals within 10 miles of CBM development are likely to experience water level drops and possibly methane occurrence. Flowing artesian wells and springs that are sourced within coals in this area are likely to experience decrease in flow rate. Wells and springs in Wasatch are not expected to be substantially affected unless they are within 100 feet (vertically) of developed coal.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
<i>Surface Water</i>				
Quantity	Perennial flows likely to develop in formerly ephemeral channels	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
	High seasonal flows expected to rise	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
CBM Produced Water discharged to surface	476,216 acre-feet	179,171 acre-feet	270,781 acre-feet	181,807 acre-feet
Quality	Negligible changes in water quality of main stems.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
	Concentrations of suspended sediment in surface waters likely to rise above present levels due to runoff from disturbed areas.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
	SAR values and sodium concentrations may inhibit the use of irrigation on some tributaries.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
	Evaporation may cause concentrations of salts and other metals in impoundments and surface drainages.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Surface Drainages	Erosion of surface drainages would occur due to increased flows.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
	Channels are more likely to overbank during snowmelt due to increased flows from CBM discharges	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Surface Waterbodies	Reservoirs downstream likely would receive more water and could receive more sediment.	Numerous impoundments would serve as flood control structures during high seasonal flows.	Same as Alternative 1	Same as Alternative 1
	Springs may develop in drainages where infiltration is enhanced.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1

Table S-2 Summary of Effects, by Alternative

Potential Effect	Alternative			
	1	2A	2B	3
Surface Water Use	Increased availability of surface water for irrigation and other downstream beneficial uses.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
	Potential reduction of flows by impoundments may diminish water availability to permitted water right holders downstream	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
<i>Physiography, Geology, Paleontology, and Minerals</i>				
Paleontology	If Class 3, 4, or 5 formations are present in areas of disturbance, disturbing activities could damage or destroy surface and sub-surface fossils.	Similar to Alternative 1, but with a higher potential due to a larger amount of disturbance.	Similar to Alternative 1, but with a higher potential due to a larger amount of disturbance.	Similar to Alternative 1, but with a reduced potential due to a smaller amount of disturbance.
Minerals	Would produce about 16 trillion cubic feet of CBM. Would produce about 220 million barrels of oil equivalent from the non-CBM wells.	Same as Alternative 1	Same as Alternative 1	Would produce about 8 trillion cubic feet of CBM. Would produce about 100 million barrels of oil equivalent from the non-CBM wells.
Geological Hazards	Implementation is unlikely to cause noticeable ground subsidence or increase the potential for underground coal fires. Migration of some CBM could occur within the PRB as development of CMB occurs.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1. but to a smaller extent due to the smaller number of wells.
<i>Soils</i>				
Erosional effects from facilities located on soils with high wind erosion potential	Increased wind erosion due to removal of vegetation, excavation, and stockpiling of soil, especially in sandy soils. Approximately 25,474 acres in the short term and 13,403 acres in the long term would be disturbed on soils with a high wind erosion potential.	Nearly the same as Alternative 1, with a very minor increase in disturbed area because of the change in water handling options. Due to the decrease in Surface Discharge and the increase in impoundments, the potential for wind erosion would increase slightly.	Nearly the same as Alternative 1, with a very minor increase in disturbed area because of the change in water handling options. Due to the decrease in Surface Discharge and the increase in impoundments, the potential for wind erosion would increase slightly, but increase would be less than in Alternative 2A.	All disturbance would be roughly cut in half. As Alternative 3 would employ the same water handling options as Alternative 1, effects would be similar but on a smaller scale.

Table S-2 Summary of Effects, by Alternative

Potential Effect	Alternative			
	1	2A	2B	3
Erosional effects from facilities located on soils with high water erosion potential	Increased water erosion and sedimentation due to removal of vegetation, excavation, slope steepening and compaction, especially in clayey soils. Approximately 76,691 acres in the short term and 38,452 acres in the long term would be disturbed on soils with high water erosion potential. Soil loss estimates on these soils range from 3.4 to 18.7 tons/acre/year on bare soil and 0.5 to 2.6 tons/acre/year one year after reclamation.	Nearly the same as Alternative 1, with a very minor increase in disturbed area because of the change in water handling options. Due to the decrease in Surface Discharge and the increase in impoundments, the potential for water erosion would increase slightly.	Nearly the same as Alternative 1, with a very minor increase in disturbed area because of the change in water handling options. Due to the decrease in Surface Discharge and the increase in impoundments, the potential for water erosion would increase slightly, but increase would be less than in Alternative 2A.	All disturbance would be roughly cut in half. As Alternative 3 would employ the same water handling options as Alternative 1, effects would be similar but on a smaller scale.
Facility location on slopes greater than 25 percent	No facilities would be located on sloped greater than 25 percent. Roads would be located to avoid steep slopes	No facilities would be located on sloped greater than 25 percent. Roads would be located to avoid steep slopes	No facilities would be located on sloped greater than 25 percent. Roads would be located to avoid steep slopes	No facilities would be located on sloped greater than 25 percent. Roads would be located to avoid steep slopes
Effects on soil productivity	Reduction in soil productivity due to removal of vegetation, compaction, changes in salinity, excavation and stockpiling of soil. Approximately 206,777 acres in the short term and 103,800 acres in the long term would be disturbed on soils with high compaction potential, low revegetation potential, high salinity, or on Prime Agricultural soils.	Nearly the same as Alternative 1, with a very minor increase in disturbed area because of the change in water handling options. Due to the decrease in Surface Discharge and the increase in impoundments, the potential for infiltration would be reduced but soil mixing and compaction would increase slightly.	Nearly the same as Alternative 1, with a very minor increase in disturbed area because of the change in water handling options. Due to the decrease in Surface Discharge and the increase in impoundments, the potential for infiltration would be reduced but soil mixing and compaction would increase slightly. These changes in effects from Alternative 1 would be less than those experienced under Alternative 2A.	All disturbance would be roughly cut in half. As Alternative 3 would employ the same water handling options as Alternative 1, effects would be similar but on a much smaller scale.
<i>Air Quality</i>				
Compliance with Wyoming and federal ambient air quality standards	Yes	Yes	Yes	Yes

Table S–2 Summary of Effects, by Alternative

Potential Effect	Alternative			
	1	2A	2B	3
Within range of States' hazardous air pollutant thresholds for maximum 8-hour concentrations	Yes	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
N-Hexane	Yes			
Benzene	Yes			
Toluene	Yes			
Ethylbenzene	Yes			
Xylene	Yes			
Formaldehyde	Above strictest threshold, but well within range			
Compliance with cancer risk threshold:		Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Benzene	Yes			
Formaldehyde	Yes			
Compliance with visibility thresholds in sensitive Class I and Class II areas:				
$\Delta dV > 1.0$ dV	Up to 11.5 days	Up to 10.3 days	Up to 9.5 days	Up to 6.6 days
$\Delta dV > 0.5$ dV	Up to 43.7 days	Up to 41.1 days	Up to 37.9 days	Up to 28.7 days
<i>Vegetation</i>				
Overall long-term vegetation displacement	128,069 acres	146,963 acres	138,937 acres	52,231 acres
Sagebrush shrublands	40,007 acres	45,943 acres	43,517 acres	15,311 acres
Riparian, wetlands	3,327 acres	7,266 acres	3,402 acres	2,999 acres
<i>Wildlife</i>				
Big Game Species' Important Habitats				
Pronghorn Winter-yearlong range	Approx. 2 percent of this range would be disturbed in the Project Area over the long-term.	Same as Alternative 1	Same as Alternative 1	Approx. 1 percent of this range would be disturbed in the Project Area over the long-term.
White-tailed Deer Winter-yearlong and Yearlong Ranges	Less than 1 percent of both ranges would be disturbed in the Project Area over the long term. 100 percent of the winter-yearlong disturbance would occur in the Middle Powder River sub-watershed.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Mule deer winter-yearlong range	Approximately 1 percent of winter-yearlong range would be disturbed in the Project Area over the long-term — about 50 percent of which would occur in the Upper Powder River sub-watershed.	Less than 1 percent of winter-yearlong range would be disturbed in the Project Area over the long-term — about 50 percent of which would occur in the Upper Powder River sub-watershed.	Approximately 1 percent of winter-yearlong range would be disturbed in the Project Area over the long-term — approximately 58 percent of which would occur in the Upper Powder River sub-watershed.	Less than 1 percent of winter-yearlong range would be disturbed in the Project Area over the long-term 100 percent of which would occur in the Upper Powder River sub-watershed.

Table S-2 Summary of Effects, by Alternative

Potential Effect	Alternative			
	1	2A	2B	3
Elk crucial winter range (Fortification Creek)	Approximately 3 percent of crucial winter range would be disturbed in Fortification Creek Management Area.	Approximately 4 percent of crucial winter range would be disturbed in Fortification Creek Management Area.	Same as Alternative 1	Same as Alternative 1
Big Game	Habitat fragmentation may alter big game use of habitats. Human disturbance may deter big game from otherwise suitable habitats to potentially lower quality habitats. Increased human activities may result in increased vehicle collisions, poaching and legal hunting success.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Raptors	Disturbance of ground nesting and prey habitats would occur. Increased human presence may alter raptor activity patterns. New utility poles may provide new perch sites for raptors. New aboveground lines and the potential for increased vehicle/wildlife collisions may increase mortality of local raptors. Habitat disturbance may alter local prey availability.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Sage and Plains Sharp-tailed Grouse	Habitat disturbance may occur in suitable nesting, feeding and brood rearing habitats; increased human activity may affect nesting, breeding, and brood rearing; Increased number of above-ground utility lines may result in increased number of grouse collisions if appropriate mitigation efforts are not implemented.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Waterfowl	Habitat disturbance may be local beneficial or detrimental depending on local hydrological conditions. Benefits may include creation of new habitats and/or improvements of existing habitats. Production waters may also result in the elimination or degradation of existing habitats. Indirect effects to aquatic plants and invertebrates may occur from exposure to elevated levels of salts and metals in production waters.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1

Table S–2 Summary of Effects, by Alternative

Potential Effect	Alternative			
	1	2A	2B	3
Aquatic Life	Surface discharge of produced CBM water in 10 sub-watersheds would potentially increase stream flows, increases in sedimentation, increases of salt concentrations in streams and ponds, and increases of heavy metal concentrations in streams and ponds. The largest amount of surface discharge (62% of 39,367 wells) is proposed under this alternative and would result in the most potential effects to aquatic species.	Surface discharge of produced CBM water in 10 sub-watersheds would potentially increase stream flows, increases in sedimentation, increases of salt concentrations in streams and ponds, and increases of heavy metal concentrations in streams and ponds. 25% of 39,367 wells are proposed to surface discharge under this alternative and would result in less potential effects to aquatic species than Alt. 1 and Alt. 2B.	Surface discharge of produced CBM water in 10 sub-watersheds would potentially increase stream flows, increases in sedimentation, increases of salt concentrations in streams and ponds, and increases of heavy metal concentrations in streams and ponds. 40% of 39,367 wells are proposed to surface discharge under this alternative and would result in more potential effects to aquatic species than Alt. 2A and less than Alt. 1.	Surface discharge of produced CBM water in 10 sub-watersheds would potentially increase stream flows, increases in sedimentation, increases of salt concentrations in streams and ponds, and increases of heavy metal concentrations in streams and ponds. The least amount of surface discharge (54% of 15,458 wells) is proposed under this alternative and would result in the smallest amount of potential effects to aquatic species of all Alternatives.
<i>Threatened, Endangered, or Sensitive Species</i>				
Black-tailed prairie dog	Project activities would directly affect individuals and suitable habitats, if appropriate mitigation measures are not implemented.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Preble’s meadow jumping mouse	No affects to this species due to assumed lack of occurrence within the Project Area.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Black-footed ferret	No affects to this species due to assumed lack of occurrence within the Project Area.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Bald eagle	Nesting and winter roosting may be affected by increased human activities and local habitat disturbance; and elevated traffic levels in the Project Area may increase eagle/vehicle collisions if mitigation measures are not implemented.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Mountain plover	Human disturbance to suitable nesting and brood rearing habitats may affect this species.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Western boreal toad	No affects to this species due to assumed lack of occurrence within the Project Area.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1

Table S-2 Summary of Effects, by Alternative

Potential Effect	Alternative			
	1	2A	2B	3
<i>Cultural Resources</i>				
Total number of cultural resource sites that may be affected (based on known site densities):	3,288	3,604	3,435	1,696
General Distribution of Effects	The greatest anticipated effects would be in the Clear Creek, Upper Powder River, Crazy Woman Creek and Antelope Creek sub-watersheds. It is expected that 430 sites may be historic properties requiring some form of protection or mitigation.	The greatest anticipated effects would be in the Clear Creek, Upper Powder River, Crazy Woman Creek and Antelope Creek sub watersheds. It is expected that 470 sites may be historic properties requiring some form of protection or mitigation. Because of additional water handling facilities along the drainages, this alternative is likely to require more protective or mitigative measures than the other alternatives.	The greatest anticipated effects would be in the Clear Creek, Upper Powder River, Crazy Woman Creek and Antelope Creek sub watersheds. It is expected that 445 sites may be historic properties requiring some form of protection or mitigation.	The greatest anticipated effects would be in the Clear Creek, Upper Powder River, Crazy Woman Creek and Antelope Creek sub watersheds. It is expected that 220 sites may be historic properties requiring some form of protection or mitigation. Some infrastructure or support facilities may occur on federal surface for private development, but federal control over the identification and protection of historic properties would be minimal.
<i>Land Use and Transportation</i>				
Displacement of Rangeland Resources				
Short-term (acres)	229,591	248,485	240,459	108,406
Long-term (acres)	123,201	142,095	134,069	51,396
Additional Vehicle Trips				
Construction and Installation	3,129	3,630	3,366	1,059
Operation and Maintenance	790	790	790	506
Decommissioning & Reclamation	1,206	1,444	1,324	230
Change in average daily traffic relative to Existing Conditions	Over the entire Project Area, the average daily traffic is expected to increase more than 25 percent. The amount of increase on specific roads would vary greatly.	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1

Table S-2 Summary of Effects, by Alternative

Potential Effect	Alternative			
	1	2A	2B	3
<i>Visual Resources</i>	317 wells, associated roads, and water handling facilities would be constructed on VRM Class II areas. Class II management objectives would be met if mitigation were successfully implemented. Management objectives for 3,939 wells and associated facilities for Class III areas and 4,530 wells and associated facilities for Class IV areas would be met. 437 wells and associated facilities would be constructed on TBNG areas managed with (Scenic Integrity Objectives (SIO) of Low. Desired conditions for SIO would be met, in that facilities can be visible if they are reasonably mitigated to blend and harmonize with natural features.	Wells and roads are same as Alternative 1. Water handling methods would disturb 6,682 additional acres. Class II management objectives would be met if mitigation were successfully implemented.	Wells and roads are same as Alternative 1. Water handling methods would disturb 6,682 additional acres as in Alternative 2A. However, a smaller number of acres would be disturbed by impoundments than Alternative 2A, with a proportionately smaller visual impact. Class II management objectives would be met if mitigation were successfully implemented.	No wells and associated facilities would be constructed on federal leases. Visual impacts from construction and operation would occur on State and private lands.
<i>Recreational Resources</i>	Construction activities would alter the recreational experience through a loss of solitude and the natural setting. After construction, the loss of solitude would be less because of greatly reduced traffic. Installation and operation of facilities would still affect the natural setting of the Project Area for the life of the project. Recreation in special management areas would not be affected. BLM and FS objectives for recreation would be met.	The effect on recreational opportunities from the construction of wells and associated facilities are same as Alternative 1. Water handling methods would disturb an additional 6,682 acres, resulting in a greater loss of solitude and the natural setting.	The effect on recreational opportunities from the construction of wells and associated facilities are same as Alternative 1. Water handling methods would disturb 6,682 additional acres as in Alternative 2A. However, a smaller number of acres would be disturbed by impoundments than Alternative 2A, with a proportionately smaller loss of solitude and the natural setting.	No wells and associated facilities would be constructed on federal leases. No impacts to recreation would occur on BLM lands or the TBNG. Loss of solitude and natural setting could occur on State and private lands.
<i>Socioeconomics</i>				
Effects to Employment	<ul style="list-style-type: none"> ➤ 1,974 CBM workers and 67 non-CBM workers would be required. ➤ Employment would be greatest in first 10 years. ➤ Workers already exist in the community. ➤ Secondary employment would be sustained for a longer period than previously anticipated. 	<ul style="list-style-type: none"> ➤ 2,260 CBM workers and 67 non-CBM workers would be required. ➤ Employment would be greatest in first 10 years. ➤ Workers already exist in the community. 	<ul style="list-style-type: none"> ➤ 2,112 CBM workers and 67 non-CBM workers are required. ➤ Employment would be greatest in first 10 years. ➤ Workers already exist in the community. 	<ul style="list-style-type: none"> ➤ 607 new CBM and 30 non-CBM workers would be required. ➤ Employment would be greatest in first 10 years. ➤ Workers already exist in the community.

Table S-2 Summary of Effects, by Alternative

Potential Effect	Alternative			
	1	2A	2B	3
Effects to Wages	<ul style="list-style-type: none"> ➤ Combined annual payroll of the Companies would average an estimated \$81.6 million. ➤ Over a 20 period \$1.6 billion in personal income would be generated. ➤ Once the project is completed, a reduction in total annual income in the four counties would decline. 	<ul style="list-style-type: none"> ➤ Combined annual payroll of the Companies would average an estimated \$93 million. 	<ul style="list-style-type: none"> ➤ Combined annual payroll of the Companies would average an estimated \$87.1 million. 	<ul style="list-style-type: none"> ➤ Combined annual payroll of the Companies would average an estimated \$25.5 million.
Effects on housing and community infrastructure	<ul style="list-style-type: none"> ➤ Minor employment/population changes are anticipated because most employees are expected to be hired locally. ➤ Rental vacancy rates for 2000 were .2% lower than the average for Wyoming. Additional rental units may be constructed if existing supply of vacant rental units become exhausted. ➤ Due to the minor population influx, there would be minimal impact to water supply, wastewater systems, solid waste disposal, schools, fire protection, and medical facilities. ➤ The Proposed Action would result in increased traffic on roads and therefore road maintenance demands (see transportation). 	<ul style="list-style-type: none"> ➤ No change from proposed action ➤ Increase road maintenance due to construction and maintenance of water handling facilities. 	Same as Alternative 2A	<ul style="list-style-type: none"> ➤ Population change would not occur and there would be no negative housing or infrastructure effects.

Table S-2 Summary of Effects, by Alternative

Potential Effect	Alternative			
	1	2A	2B	3
Royalties and taxes generated	<ul style="list-style-type: none"> ➤ Federal Royalties = \$3.1 billion ➤ State Royalties = \$462 million ➤ Sales tax (4% paid to State, 1% paid to counties) = \$76.6 million ➤ Severance (paid to State) = \$2.4 billion ➤ Ad Valorem (paid to four counties) ➤ Campbell Co. = \$1.5 billion ➤ Converse Co. = \$32 million ➤ Johnson Co. = \$690 million ➤ Sheridan Co. = \$443 million 	<ul style="list-style-type: none"> ➤ Same royalties as Proposed Action ➤ More taxes would be generated due to the number and cost of water handling facilities. 	Same as Alternative 2A	<ul style="list-style-type: none"> ➤ \$3.1 billion less in Federal Royalties ➤ \$835 million less in Severance Tax ➤ \$1.06 billion less in ad valorem tax ➤ Not drilling Federal wells may result in future negative production rates from Federal minerals, due to depletion from drilling on State and private lands.
Water handling cost to industry (all other development costs are constant among Alternatives 1, 2A, and 2B)	Surface Discharge = \$954 million Infiltration = \$1.05 billion Containment = \$226 million LAD = \$36 million Injection = \$170 million TOTAL = \$ 2.4 billion	Surface Discharge = \$360 million Infiltration = \$2.23 billion Containment = \$263 million LAD = \$115 million Injection = \$184 million TOTAL = \$3.1 billion	Surface Discharge = \$1.2 billion Infiltration = \$1.6 billion Containment = \$239 million LAD = \$115 million Injection = \$184 million TOTAL = 3.3 billion	Surface Discharge = \$363 million Infiltration = \$478 million Containment = \$98 million LAD = \$16.7 million Injection = \$73 million TOTAL = \$1.03 billion
Non-water handling costs (Drilling, O & M, Reclamation)	\$5.84 billion	\$5.84 billion	\$5.84 billion	\$2.28 billion
Net Cost of Alternative	\$8.28 billion	\$8.96 billion	\$9.17 billion	\$3.31 billion